

*Deto*, a Subantarctic Genus of Terrestrial Isopoda. By CHARLES CHILTON, M.A., D.Sc., LL.D., M.B., C.M., F.L.S., Professor of Biology, Canterbury College, New Zealand.

(PLATES 39 & 40.)

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INTRODUCTORY AND HISTORICAL.

The genus *Deto* was established by Guérin in 1836 for a species, *D. echinata*, which was vaguely described as having been found in the East by Olivier; the chief character of the genus was that the antennæ were composed of nine joints, *i. e.* five in the peduncle and four in the flagellum, and was thus distinguished from *Oniscus*, which had three joints in the flagellum, and from *Porcellio*, which had only two. The genus was afterwards mentioned by Milne-Edwards (1840)\* and Dana (1853), but no further addition to our knowledge of it was made for many years. In 1843 Krauss included the species in his list of South African Crustacea as having been collected on the sea-shore at Table Bay, and later on it was collected at the Cape by the 'Novara' Expedition. Besides the type-species, two others were afterwards described under this genus, namely, *D. spinicornis*, Brandt, from the southern shores of the Sea of Okhotsk, and *T. whitei*, Kinahan, of unknown locality; it appears likely, however, that the latter species is identical with the type-species. In 1879 Budde-Lund in his 'Prospectus generum specierumque Crustaceorum Isopodum Terrestrium,' gave the genus with these three species, and thinking that *Deto spinicornis* was rightly referred to the genus, he placed the genus under his second family *Ligiæ*. Later on, however (1885), finding, on an examination of the poorly preserved specimens in the St. Petersburg Museum, that *D. spinicornis* should probably be referred to *Trichoniscus*, and having had an opportunity of examining two species really belonging to *Deto*, he came to the conclusion that the genus should come near to *Oniscus*, and that it is perhaps not

\* The references are made by the year of publication to the bibliographical list on pp. 454, 455.

distinct from that genus. In his 'Crustacea Isopoda Terrestria' (1885, p. 233), he gave a diagnosis of the genus and included under it two species, *D. echinata*, Guérin, and a new species *D. acinosa*, of both of which he had examined specimens from South Africa in the St. Petersburg Museum; he mentioned also *D. whitei*, but stated that it is probably the same as *D. echinata*.

For many years after this no further addition was made to our knowledge of this genus, but in 1906, Budde-Lund, having had an opportunity of examining specimens of a *Deto* collected by the German Polar Expedition at St. Paul's Island, in the Indian Ocean, gave a revision of the genus, describing these specimens as a new species, *D. armata*, and established two new species, *D. magnifica* and *D. robusta*, on three specimens from the Auckland Islands, New Zealand, preserved in the Dresden Museum. He also assigned to the genus *Deto* a species that had been described in 1879 by Mr. G. M. Thomson under the name *Actæcia aucklandiæ*, and which, in 1901, I had provisionally placed under *Scyphax*; also another species from New Zealand described in 1885 by Filhol under the name *Oniscus novæ-zealandiæ*, and the species *Philougria marina*, described by me in 1884 from the East Coast of New South Wales. Budde-Lund thus gives eight species under the genus, but of these, two, *D. magnifica* and *D. robusta*, are, I think, undoubtedly synonyms of *D. aucklandiæ*. In 1910 I pointed this out and stated that two species of Isopoda, described from Chili by Nicolet in 1849, namely, *Oniscus bucculentus* and *O. tuberculatus*, were male and female of a species of *Deto*, and were probably identical with *O. novæ-zealandiæ*, Filhol.

Before the publication of Budde-Lund's paper in 1906, I had obtained specimens of the two New Zealand species and had commenced a report on the genus, describing the mouth-parts and the pleopoda, which, up to that time, were practically unknown, as the only specimens available to Budde-Lund in 1885 had been dried or poorly preserved. My paper was long delayed through lack of sufficient specimens of the different species, but later on the Director of the South African Museum very kindly supplied me with specimens of the two species found in South Africa, and I have recently received additional specimens of *D. novæ-zealandiæ*, Filhol, from Stewart Island, New Zealand. I have thus been able to see specimens of all the species that I consider to be good ones, except *D. armata*, Budde-Lund, and in this paper I endeavour to give a fairly full account of the genus.

The genus is an extremely interesting one on account of the large size and striking appearance of some of the species, the remarkable and varied sexual differences, the strictly maritime habitat of all the species, and the geographical distribution.

I recognise six species—two from South Africa, two from New Zealand (one of which is found also in South America), another species from St. Paul's Island in the Indian Ocean, and the sixth from the East Coast of Australia.

In his last Revision of the Terrestrial Isopoda, Budde-Lund (1904) placed *Deto* under a subfamily *Detonina* of the Oniscidæ, and Stebbing (1910, p. 444) has since raised this to the rank of a family. In 1901 I placed the genera *Scyphax*, Dana, *Actæcia*, Dana, and *Scyphoniscus*, Chilton, under Scyphacidæ, a family distinct from, though closely allied to, the Oniscidæ; in this family I had also included *Actæcia aucklandiæ* (G. M. Thomson), of which I had been able to examine a single female specimen, but whose affinities to *Deto* I had not then recognised. An examination of the whole of the species shows that *Deto* would readily come under this family as then defined by me, and the genera mentioned seem to be sufficiently closely allied to justify us in placing them in one family rather than in establishing three or four separate families or subfamilies for their reception.

I shall now give diagnoses of the genus and of the different species of *Deto*, reserving some general remarks on the genus for the conclusion of the paper.

#### Family SCYPHACIDÆ.

- Scyphacina*, Dana, 1853, p. 716.  
*Scyphacidae*, Chilton, 1901, p. 121.  
 „ Richardson, 1905, p. 671.

The description of this family given in 1901 was as follows:—“Mandibles without molar tubercle, its place being taken by a tuft of long stiff setæ or bristles; inner lobe of first maxilla with two plumose bristles; maxillipeds with the terminal joints fairly well developed, lamellar, longer than the masticatory lobe; external male organ single.”

The characters of the genus *Deto* come well within this definition.

#### Genus DETO, Guérin, 1834.

- Deto*, Guérin, 1836, notice 21, p. 1.  
 „ Milne-Edwards, 1840, vol. iii. p. 174.  
 „ Budde-Lund, 1879, p. 9.  
 „ Budde-Lund, 1885, p. 233.  
 „ Budde-Lund, 1906, p. 84.  
 „ Chilton, 1909, p. 666.  
 „ Stebbing, 1910, p. 444.

The generic description given by Budde-Lund in 1885 was based on the examination of imperfect specimens of two species only; in 1906, having been able to examine additional specimens, including well-preserved specimens

of the new species *Deto armata*, he gave an amended diagnosis, the main characters of which are included in the following diagnosis which I now suggest:—

*Generic diagnosis*.—General shape of body oblong-oval, somewhat depressed; animal not capable of rolling itself into a ball; epimera lamellarly expanded\*; dorsal surface usually with spines or tubercles which are better developed in the male than in the female; pleon not abruptly narrower than peræon; epimera of third, fourth, and fifth segments well developed. Head with lateral processes forming broad lobes.

Eyes of moderate size, with many ocelli.

Antennæ with flagellum four-jointed.

Mandibles with one penicil behind the cutting-edge.

Maxillipeds with palp longer than masticatory lobe, and showing indications of being formed of three or four joints.

Exopoda of the pleopoda opercular, and containing no special branchial organ.

Uropoda produced, reaching considerably beyond the terminal segment.

In addition to the points given above, there are several characters common to these species which may be mentioned here to avoid repetition.

Sexual dimorphism is very marked and affects the surface of the body and the antennæ, but not the peræopoda or uropoda, which are the parts that usually show sexual differences in *Trichoniscus*, *Porcellio*, &c.

The antennæ are long and stout, usually stouter in the male than in the female.

The mouth-parts are on the same general type of those of *Oniscus*, and are fairly uniform throughout the genus. I have described them in greater detail for *D. aucklandiæ* and *D. bucculenta*, but a few points may be given here.

The mandibles are strong; the accessory appendage differs on the two sides, in the left mandible being formed of two or three strongly chitinised teeth similar to the outer cutting-edge, in the right it is shorter and ends in a crown of small teeth of varying sizes; at the base of the accessory appendage in both mandibles is a hairy lappet which may bear one or two stout setæ or "penicils" similar to the single penicil between the lappet and the tuft of long bristles representing the molar tubercle.

The lower lip consists of two rounded lobes separated apparently to the base, but connected proximally by the inner more membranous lobes which appear capable of being folded together at right angles to the lip, and when

\* In the female of *Deto aucklandiæ* the epimera of segments 2, 3, and 4 of the peræon are separated from their segments by a slight groove or apparent suture; in the males of this species and in both sexes of the other species the epimera are quite continuous with their segments, the junction not being marked by any groove or suture.

spread out of filling the space between the outer lobes when they are separated laterally.

The first maxilla is of normal shape, its narrow inner lobe bearing two densely hairy bristles.

The second maxilla is somewhat curved near the base, but the outer edge is not angularly produced as in *Oniscus*, &c.

The maxillipeds have the epipod large, flanking the basal part, and tapering distally; the second joint is broad, but not so much expanded as in *Oniscus*; the palp is longer than the masticatory lobe and shows indications of the separate joints of which it is composed.

The pleopoda are of the same type as those of the Oniscidæ; the inner ramus of the second pair in the male is particularly long, terminating in a very long slender lash.

The uropoda vary in the different species and are described below; they are the same in the two sexes.

Budde-Lund (1906) divided the genus into two subgenera with the following characters:—

Subgenus *Deto*:

1. Antennæ rather long and slender; joints of flagellum fairly long.
2. Palp of maxillipeds a little longer than the masticatory lobe.
3. Endopod of uropod short, scarcely reaching to the middle of the exopod.

Subgenus *Vinneta*:

1. Antennæ rather short, stout; joints of flagellum very short.
2. Palp of maxillipeds much longer than the masticatory lobe.
3. Endopod of uropod rather long, longer than exopod.

Of these three characters the first two do not appear to me to be reliable for subgeneric characters. It will be seen from the descriptions given below that in most of the species the antennæ differ considerably in the two sexes, and that while the male may have the antenna very stout, in the female it may be fairly slender, with the joints of the flagellum of moderate length. Again, the palp of the maxillipeds is in all cases longer than the masticatory lobes, and the differences in its length are not sufficient to be of much importance.

The third point seems, however, to be a good one and enables the species at present known to be separated into two groups, one including the species found in New Zealand and South America, and the other the species in South Africa, St. Paul's (Indian Ocean), and Australia.

Owing to the great differences between the male and the female, and the fact that in this, as in many genera of the Isopoda and Amphipoda, the females of the different species are nearly alike, it is hopeless to try to distinguish between the species without making use of the characters of

the fully developed male ; unfortunately the male in *D. marina* is not known. The others may, however, be distinguished as follows :—

- A. Uropod with exopod reaching much beyond the endopod ..... Subgenus *Deto*, Budde-Lund.
1. Male with a pair of long spines on each segment of peræon, pleon without spines ..... *D. echinata*.
  2. Male with a pair of spines (or prominent tubercles) on each segment of peræon, and on third and fourth segments of pleon ..... *D. armata*.
  3. Male with a pair of tubercles (not spines) on each segment of peræon ..... *D. acinosa*.
  4. Male unknown ; female with surface granular, or with low tubercles only ..... *D. marina*.
- B. Uropod with exopod not reaching beyond endopod. Subgenus *Vimeta*, Budde-Lund.
1. Male with lateral portions of first segment of peræon not expanded ; surface of peræon with prominent blunt spines ..... *D. aucklandicæ*.
  2. Male with lateral portions of first segment of peræon forming balloon-like expansions ; surface of peræon with irregular pointed tubercles ..... *D. bucculentu*.

DETO ECHINATA, *Guérin*. (Pl. 39. figs. 1-3.)

*Deto echinata*, Guérin, 1836, notice 21, p. 2, pl. 14.

” ” Milne-Edwards, 1840, vol. iii. p. 174.

” ” Krauss, 1843, p. 63.

” ” Heller, 1868, p. 137.

” ” Budde-Lund, 1879, p. 9.

” ” Budde-Lund, 1885, p. 234.

” ” Stebbing, 1893, p. 431.

” ” Budde-Lund, 1906, p. 85.

” ” Stebbing, 1910, p. 444.

? *Deto Whitei*, Kinahan, Dublin Zool. Bot. Assoc. i. p. 199, pl. 19, fig. 6 ; see also Ann. & Mag. Nat. Hist. ser. 5, vol. xvii. p. 83.

*Male*.—Oblong-oval, more than twice as long as broad. Head with a prominent subacute tubercle on each side near the posterior margin and internal to the eyes, with another smaller tubercle anterior and interior to the first ; rest of surface granular ; lateral lobes moderately large, directed outwards and forwards, their extremities broadly rounded.

Each segment of peræon with a pair of long acute spines, straight or slightly curved, arising near the posterior margin and projecting vertically, those on the posterior segments directed also a little backwards ; the spines on the first segment are the shortest, those on the succeeding segments longer till the fourth and fifth, which are subequal and much longer than the segment from which they arise, each of the sixth and seventh a little shorter than the preceding one. Rest of surface of peræon finely granular

or slightly rugose, more especially on the anterior segments. Epimera large, each with a faint ridge running backwards and outwards towards its posterior angle.

Surface of pleon smooth; epimera of third, fourth, and fifth segments largely developed, last segment triangular, nearly twice as broad as long, apex rounded.

Uropoda with basal joint broad, reaching slightly beyond the end of the last segment, upper surface raised in middle into a longitudinal keel, lateral margin somewhat expanded; outer ramus long, lanceolate, fully twice as long as base; inner ramus only about as long as the base, not in contact with its fellow on the other side.

*Female*.—Differs from male in having the body more oval, the long spines represented only by rounded tubercles, the oblique ridges on the epimera rather better marked, and the antennæ more slender.

Length of male (without uropods) 22 mm., breadth 10 mm.

Length of female 20 mm., breadth 9 mm.

*Colour*. Slaty grey, with marbled markings of lighter colour.

*Habitat*. Table Bay, Cape Colony, collected on sea-shore with *Ligia glabrata* by Krauss; collected at "The Cape" by the 'Novara' Expedition; the specimens from the South African Museum submitted to me are labelled:—"Sea-shore at Hout Bay, Cape Peninsula, W. L. Sclater coll., April 1901," and "Sea-shore at Scuilphoek, 2 to 3 miles south of Hermanuspetrusfontein, Caledon District, Cape Colony, R. M. Lightfoot coll., February 1903."

Of this species I have seen several males, but only one female; the males are all of about the same size, and have the pair of long slender spines on each segment of the peræon well developed; the spines are considerably longer than those of *D. armata* as figured by Budde-Lund. In the single female the dorsal surface is granular, more so than in the male, and the spines are represented only by small, rounded, light-coloured tubercles projecting only slightly above the general surface.

The species appears to be considerably larger than *D. acinosa*, but closely resembles that species in its appendages.

DETO ACINOSA, *Budde-Lund*. (Pl. 39. figs. 4-18.)

*Deto acinosa*, Budde-Lund, 1885, p. 235.

" " Stebbing, 1893, p. 431.

" " Budde-Lund, 1906, p. 85.

*Male*.—Oblong-oval, fairly convex. Head with a rather large rounded tubercle on each side near the posterior border and internal to the eyes, rest of surface coarsely granular. Each segment of the peræon with a large subacute tubercle on each side near the posterior margin, projecting upwards and backwards to a distance equal to half the length of the segment from

which it arises ; on the anterior segments, especially the first, the surface in front of these tubercles shows a few irregular granulations ; epimera well developed, not separated from their segments by a suture, each with a faint oblique ridge running outwards and backwards to the posterior angle, the ridge best marked on the posterior segments. Pleon with surface smooth, epimera of segments 3, 4, and 5 well developed ; last segment triangular, its extremity rounded.

*Female*.—Differs from the male in lacking the prominent tubercles on the segments of the peræon ; surface of head and peræon granular, the position of the tubercles on the peræon represented by a granule slightly more prominent than the others. Antennæ rather more slender than in the male.

Length 13 mm., width 6·5 mm.

*Colour*. Slaty grey, tips of tubercles and lateral portions lighter in colour, some lighter markings also on the general surface.

*Habitat*. Cape Peninsula, South Africa, on sea-shore ; two specimens in the St. Petersburg Museum from "Africa" ; many specimens in South African Museum from "Sea-shore at Sea Point, Cape Peninsula, R. M. Lightfoot coll."

Of this species I have seen many specimens of both sexes and of different sizes. It is a smaller species than *D. echinata*, and does not present such marked sexual differences, though the pointed tubercles or teeth on the peræon are quite prominent in the adult male ; in the figure they are perhaps made a little too prominent.

The antenna of the male is shown in fig. 6 ; it is similar to that of *D. echinata*, but has the joints of the flagellum slightly longer.

The upper lip (fig. 7) has the margin broadly rounded and fringed with short setæ.

The mandibles (fig. 8) have only about ten long bristles in the tuft representing the molar tubercle, and these are almost smooth except towards the end, but otherwise do not differ from those of *D. aucklandicæ*.

The lower lip (fig. 9) has the outer lobes with a slight notch near the apex, inner lobes narrow and delicate.

The first maxillæ are normal.

In the second maxilla (fig. 10) the outer lobe is nearly as broad as the inner, but not so thickly setose.

The maxillipeds (fig. 11) have the palp not much longer than the masticatory lobe, which is oblong, truncate at the end, and bears near the inner angle a small hairy appendage like a short, stout, plumose bristle.

The peræopoda (figs. 12 & 13) increase slightly in length posteriorly. They are rather spiny ; the dactyl bears a long split seta longer than the others, which appears to represent the dactylar seta, but it is not very prominent, especially in older specimens.



In the first pleopod of the male (fig. 14) the male organ is about two-thirds as long as the narrow endopod, which is grooved on its posterior aspect; the exopod is short and not produced at its inner side, its extremity being regularly rounded.

The second pleopod of the male (fig. 15) has the endopod extremely long and slender; the exopod is somewhat produced at its inner angle, and has a few very delicate plumose setæ on the outer margin.

In the female the exopod of the first pleopod (fig. 16) is short and broad with regularly curved margins, its extremity is slightly produced on the inner side and is broadly rounded; no endopod was seen.

The second pleopod of the female (fig. 17) has the exopod larger with inner angle more produced, margins with a few delicate setæ; the endopod forms a short triangular process.

The uropoda (fig. 18) are practically the same as in *D. echinata*.

#### DETO ARMATA, *Budde-Lund*.

*Deto armata*, Budde-Lund, 1906, p. 86, pl. 4, figs. 26-36.

*Specific description*.—Similar to *D. echinata*, but smaller and somewhat narrower. Head, each segment of peræon, and third and fourth segments of pleon each bearing a pair of spines which are much larger in the male than in the female; general surface minutely granular. Terminal segment with apex triangularly produced, subacute.

Antennæ long, slender, fourth joint of flagellum of moderate size. Maxillipeds with the palp a little longer than the masticatory lobe. Legs supplied with moderately long spines. Pleopoda and uropoda apparently as in *D. echinata*.

Length 12 mm.

*Habitat*. St. Paul's Island, Indian Ocean; collected by German South-Polar Expedition in 1903.

I have not seen specimens of this species, and have drawn up the specific diagnosis from the description and figures given by Budde-Lund.

The species appears to be very similar to *D. echinata*, but differs in having a pair of spines on the third and fourth segments of the pleon as well as on the peræon. Budde-Lund says nothing about the length of these spines, but if the specimen he figures is a male (as it presumably is), they are not so long as in fully grown specimens of *D. echinata*; Budde-Lund, however, gives the length of the animal as 12 mm. only, and the specimen figured may not be fully grown.

The mouth-parts, peræopoda, and pleopoda of this species have been figured by Budde-Lund; they appear to present a close general resemblance to those of *D. echinata* and *D. acinosa*.

DETO MARINA (*Chilton*). (Pl. 39, figs. 19-23.)

*Philougria marina*, Chilton, 1884, p. 463, pl. 11.

„ „ Chilton, 1901, p. 128.

„ „ Stebbing, 1900, p. 565.

*Deto marina*, Budde-Lund, 1906, p. 85, pl. 4, figs. 39-41.

*Specific description*.—Body oblong-oval, length rather more than twice the greatest breadth. Head with surface irregularly tuberculate, front projecting into a triangular lobe ending subacutely, lateral lobes very broad, occupying nearly all the side-margin; eyes large, on rounded prominences raised above the lateral lobes. Surface of peræon somewhat scabrous, with a few low inconspicuous rounded tubercles, most marked on the anterior segments; epimera not very greatly expanded, each with a slight oblique ridge running outwards and backwards to the posterior angle. Segments 3, 4, and 5 of pleon with well-developed epimera which have the posterior angles acute, terminal segment triangular, sides slightly concave, extremity broadly rounded.

Antennæ (fig. 20) about one-third the length of the body, slender, fifth joint slightly longer than the third and fourth together; flagellum as long as the fourth, its first three joints subequal in length, fourth slender, about half as long as the preceding, and merging almost imperceptibly into a pencil of very short setæ; whole surface of antenna covered with minute short spinules and fine short setæ.

Legs (figs. 21 & 22) subequal in length, the posterior ones only slightly increasing in length; all rather spiny, the largest spine, which splits towards the end, being situated near the distal end of the carpus.

Uropoda (fig. 23) with base broad, reaching to the end of the terminal segment; outer ramus longer than base, tapering to the end, which bears a few short setæ; inner ramus arising more anteriorly, slender, only slightly tapering, ending with pencil of long setæ.

Length of largest specimen (a female with brood-plates developed) 6 mm.

*Colour*. Yellowish, with marking of a dark brown.

*Habitat*. Coogee Bay, near Port Jackson, New South Wales (Chas. Chilton coll., January 1884).

This species is known only from Coogee Bay, near Port Jackson, New South Wales, where I collected it in January 1884; it was found near high-water mark, and most of the specimens were taken out of the water, which was nearly high tide at the time. Unfortunately my specimens are all small; the largest is 6 mm. long, and is a female with brood-pouches developed; the others are probably immature. I can find no adult male among my specimens, and am unable therefore to say whether there are any secondary sexual characters or not. Several friends, especially Mr. T. Whitelegge, of the Australian Museum, have since endeavoured to collect additional specimens for me from the same locality, but without success.

In its small size, more slender antennæ, and in the slender spiny peræopoda and the uropoda, this species at first shows a general resemblance to a *Trichoniscus*; the mouth-parts are, however, as was first pointed out by Stebbing (1900, p. 565), quite different, and the species is a true *Deto*.

The mouth-parts are similar to those of *D. acinosa*, and do not require special notice; the maxillipeds have been figured by Budde-Lund (1906, pl. 4, fig. 40) from a specimen given by me to the Zoological Museum of Dundee University College.

The legs (figs. 21 & 22) are slender, and in the arrangement of the spines, particularly of the large split spine towards the distal end of the carpus, are very similar to those of *Trichoniscus* and allied genera; the dactylar seta is fairly prominent—it has only two branches, one of which bears a small knob at the end.

The adult male is not known; it will be interesting to see in what characters it differs from the female.

DETO AUCKLANDIÆ (*G. M. Thomson*). (Pl. 39, figs. 24–30, and Pl. 40, figs. 31–44.)

*Actæcia aucklandiæ*, *G. M. Thomson*, 1879, p. 249.

„ „ *Budde-Lund*, 1885, p. 239.

„ „ *Filhol*, 1885, p. 443.

*Scyphax* (?) *aucklandiæ*, *Chilton*, 1901, p. 126, pl. 15, fig. 2.

*Deto aucklandiæ*, *Chilton*, 1906, p. 273.

„ „ *Budde-Lund*, 1906, p. 87.

„ „ *Chilton*, 1909, p. 666.

„ „ *Chilton*, 1910, p. 288.

*Deto magnifica*, *Budde-Lund*, 1906, p. 86.

*Deto robusta*, *Budde-Lund*, 1906, p. 86.

*Specific description*.—*Male*. Oblong-oval, moderately convex, head strongly tuberculated, with a raised oblique ridge running from near the centre outwards and backwards to the posterior margin; in the centre between these ridges are four tubercles, the posterior two larger than the two anterior, other small tubercles near the frontal margin; lateral lobes large, directed outwards, roundly tetragonal.

First segment of peræon slightly longer than the others, which are subequal, each segment bearing a transverse row of tubercles or rounded blunt-ended spines, which are directed upwards and a little backwards, the lateral ones the largest and longest, the others gradually diminishing in size towards the median line; in most cases there are ten tubercles in each row, but there are usually fewer on the first and last segments of the peræon; in the first two segments there are usually some slight tubercles in front of the transverse row. Pleon with first two segments short and without epimeral expansions, third, fourth, and fifth with large epimeral expansions

which end subacutely, a transverse row of small rounded tubercles on the second, third, fourth, and fifth segments; last segment without tubercles, surface slightly granular, much broader than long, extremity broadly rounded.

Eyes somewhat small, narrow-oblong.

Antennæ extremely thick and stout, second joint of peduncle longer than the first or third, fourth joint slightly shorter than fifth, which is narrowed at the base and expanded distally; flagellum much expanded, of three subequal joints, each much broader than long, the minute fourth joint hardly visible; last joint of peduncle and the flagellum densely covered with short woolly hairs.

Legs subequal with a few short spinules, inner margins with woolly hairs.

Uropoda with the basal portion very broad, meeting in the median line and extending slightly beyond the end of the terminal segment; outer margin expanded and produced at the outer posterior angle, inner rami contiguous along the median line, longer than the outer rami, both rami rounded at the end and covered with minute setæ.

Length of largest specimen 24 mm.; greatest breadth 11 mm.

*Colour.* Slaty grey.

*Female.*—Differing from the male in the following points:—Body broader and less convex, the tubercles on the head and peræon much smaller and less prominent, forming only small rounded tubercles; epimeral expansions, especially on the posterior segments, showing an oblique ridge running backwards and outwards; antennæ stout but much more slender than those of the male, the fifth joint of the peduncle slightly sinuous, and when folded back fitting into a groove on the outer surface of the fourth joint; flagellum about two-thirds as long as the last joint of the peduncle, its joints as long as broad or longer, the first two subequal, the third as long as these two together, fourth minute.

Length 19 mm.; greatest breadth 11 mm.

*Colour.* Slaty grey.

*Habitat.* Ewing Island, in the Auckland Islands group, New Zealand; found on the sea-shore (collected by Dr. L. Cockayne, F.R.S., and Mr. E. Jennings).

This remarkably large and striking species has been found only in the Auckland Islands, where it lives under seaweed, etc., on the sea-shore. Filhol gives the locality as "Nord de la Nouvelle-Zélande, Auckland," but this has no doubt arisen from the unfortunate confusion of the Auckland Islands, which lie about 200 miles to the south of New Zealand, with the Auckland City and Province in the north of New Zealand. I have seen only about half-a-dozen specimens, all from Ewing Island, these being all males except one. The differences between the two sexes are extremely

marked, especially in the full-grown males ; two of my male specimens are apparently not quite fully grown and have the antennæ considerably more slender than is shown in fig. 27, and more approaching the conditions found in the female, though much stouter ; the prominence of the tubercles on the peræon is also less marked in the immature males.

I think there can be no doubt that *D. magnifica*, Budde-Lund, and *D. robusta*, Budde-Lund, are synonyms of this species. Budde-Lund established these two species on three specimens from the Auckland Islands in the Dresden Museum ; of *D. magnifica* he had only one imperfect specimen, and states that it is perhaps the same as *D. aucklandiæ*. Of *D. robusta* he had one male and one female, and apparently based the specific distinction largely on the characters of the male, the differences of which from the female had not previously been fully pointed out. In his original description, Mr. Thomson, by an error, interchanged the sexes and described the female as being provided with the stout obtuse spines.

The specific diagnosis given above may be supplemented by the following more detailed description of the appendages :—

Antennules (fig. 26) small but noticeable, first joint as long as the second but shorter, third about half as long as the second, narrower, and tapering ; all covered with fine short hairs, two or three minute olfactory setæ near the end of the third.

The antennæ in the fully grown males (fig. 27) are particularly broad and powerful, all the joints being broadened and having the surface uneven, as shown in the figure ; the fifth joint is about the same length as the fourth or only slightly longer, and lies nearly at right angles to it, the outer surface of the fourth being hollowed out towards the extremity to receive it ; the flagellum is about half as long as the fifth joint and shows three subequal joints, each broader than long, the very small fourth joint being almost concealed in the fine downy hairs which cover the flagellum and the terminal portion of the peduncle.

In the female the antennæ (fig. 28) are very much more slender, but show the same proportions, except that the third joint of the flagellum is longer than either of the first two, which are subequal and about as broad as long ; the fourth joint is small, though readily noticeable ; the fine hairs found in the male are hardly represented.

In immature males the antennæ tend to resemble those of the female.

Upper lip with extremity roundly truncate.

The mandibles are large and strongly chitinated, of the same type as in *Oniscus*. In the left mandible (fig. 30) the cutting part is composed of two strong teeth somewhat rounded and dark brown in colour, within it lies the accessory appendage also composed of two strongly chitinated teeth, brown in colour, and bearing at its base a membranous, hairy lappet densely fringed with setæ ; this is followed by a single "penicil," and then by the brush-like

recurved setæ replacing the molar tubercle ; this contains a large number of long, stiff, curving bristles of varying length. In the right mandible (fig. 29) the general structure is the same, but the accessory lobe bears a number of small sharp teeth instead of ending in two large teeth as in the left mandible.

The lower lip (fig. 31) is formed of two rounded lobes, the cleft between them reaching to the base, but they are united in the proximal half by an inner folded central lobe, the inner margins and the distal half of the outer margin of the outer lobes being densely fringed with long fine setæ.

The first maxilla (fig. 32) has the usual form, the extremity of the outer lobe bears about ten stoutly chitinised spines of different sizes, its inner margin is fringed near the middle with a number of very fine delicate setæ ; the inner lobe is moderately stout and bears at the end the usual two brush-like setæ.

The second maxilla (fig. 33) is slightly curved, its outer lobe is much smaller than the inner, both being supplied with the usual setæ ; the distal portion of the outer margin is fringed with slender setæ, but there are a few on the inner margin near the base.

The maxillipeds (figs. 34 & 35) have the epipod long, about as long as the broad second joint, tapering towards the subacute extremity, its margin fringed with delicate setæ ; the enlarged second joint is expanded into a rounded lobe at the outer distal angle, fringed with long fine setæ ; the palp has a short joint at the base, and the terminal portion, though formed of a single piece, is lobed on the inner side, indicating that it is formed of four joints, each lobe bears a large number of short stout setæ ; the inner, masticatory, lobe of the maxilliped is rectangular, truncate at the extremity, densely covered with fine setæ, at the inner distal angle it bears a minute appendage covered with very short setæ.

The legs (figs. 36 & 37) are all of about equal length, the posterior ones being only slightly longer than the anterior ; in all of them the ischium is long, being about two-thirds the length of the basis, and it expands slightly distally, the merus is about subequal with the carpus, and the propod is slightly longer than either of the two preceding joints, but considerably narrower ; the dactyl is short and stout and has the basal portion thickly covered with fine short hairs ; there appears to be no special dactylar seta. On all of the joints, as shown in the figures, there are a few rather short, stout spines, and the inner margins of most of the joints, particularly the ischium, merus, carpus, and propod, are thickly covered with fine, very short, setæ. None of the legs is specially modified in the males.

The first pleopod of the male (figs. 38 & 39) has the basal joint produced laterally into a broad lamellar expansion with its angles rounded ; the exopod is operculiform, broadest near the base and tapering to a subacute apex ; the endopod is specially modified, it is somewhat broader at the base and then

narrows, remaining about the same width nearly to the extremity where it narrows somewhat suddenly and has the apex pointing slightly outwards, along its posterior margin it bears a groove. The male organ is short, reaching only about halfway along the endopod, the distal third is narrowed and it is slightly emarginate at the extremity.

The second pleopod (fig. 40) has the basal portion and the exopod similar to those of the first, except that the lateral expansion of the former is smaller; the convex inner margin of the exopod is thickly fringed with fine short setæ; the endopod is greatly narrowed and elongated and appears to be divided into two joints, the basal one short and oblong, the terminal one very long, nearly twice the length of the exopod, and ending in an extremely fine styliform process—along the anterior surface of this joint is a groove which appears to fit against the corresponding groove of the first exopod, doubtless thus forming a tube for the passage of the semen.

The third pleopod has the exopod operculiform and similar to those of the preceding pleopoda, the endopod is branchial, much shorter than the exopod, and somewhat quadrangular in shape, with rounded angles. The fourth (fig. 41) and fifth pleopoda are similar in shape and structure to the third.

In the female the first pleopod (fig. 42) has the outer ramus of the same shape as in the male but considerably smaller; it has the outer margin strongly convex proximally and concave distally, but is not distinctly bilobed as in *Oniscus*; the inner ramus was not seen, it appears to be either absent or very small. The second pleopod of the female (fig. 43) has the outer ramus larger and of the same shape: arising from the basal portion near the middle line is a small triangular appendage which appears to represent the inner ramus; it is firm and chitinous like the outer ramus and is not branchial in function.

The uropoda (fig. 44) have already been described; the upper surface of the base is somewhat keeled in the centre, and has the lateral portion expanded and slightly concave above; the uropoda are practically the same in both sexes.

DETO BUCCULENTA (*Nicolet*). (Pl. 40. figs. 45–59.)

- Oniscus bucculentus*, Nicolet (♂), 1849, p. 267, pl. 3, fig. 9.  
 " " Budde-Lund, 1885, p. 206.  
*Oniscus tuberculatus*, Nicolet (♀), 1849, p. 268.  
 " " Budde-Lund, 1885, p. 206.  
*Oniscus novæ-zealandiæ*, Filhol, 1885, p. 441, pl. 54, figs. 7–8.  
*Scyphax* (?) *aucklandiæ*, Chilton, 1901, p. 126 (in part).  
*Deto novæ-zealandiæ*, Chilton, 1906, p. 273.  
 " " Budde-Lund, 1906, p. 87.  
 " " Chilton, 1909, p. 667.  
 " " Chilton, 1910, p. 288.

*Specific description.*—*Male.* Body oblong-oval; cephalon with front not much produced in centre; lateral lobes large with outline subquadrangular, their surface fairly smooth, rest of dorsal surface of head irregularly tuberculate. First segment of peræon much wider than the cephalon, posterior margin straight with lateral angles broadly rounded, central portion with two transverse rows of tubercles, lateral portions expanded and swollen into two balloon-like bodies with outer margin convex and surface very finely spinulose. Second, third, and fourth segments with posterior margins straight or only slightly sinuous at the sides, lateral angles slightly produced; fifth, sixth, and seventh with posterior margins concave, and lateral angles more or less acutely produced. All the segments with the central parts bearing two transverse rows of irregular tubercles, some of them, especially the lateral ones, pointed at apex; on the epimera is a single row of tubercles or a raised ridge running obliquely outwards and backwards to the postero-lateral angle.

Third, fourth, and fifth segments of pleon with large epimera, and a single row of tubercles on central portion. Telson short, much broader than long, triangular, apex broadly rounded, sides a little concave.

Antennæ stout, nearly half as long as body; first three joints short, subequal, fourth nearly twice as long as third and about twice as long as broad, fifth considerably longer than fourth, narrowed at base; flagellum as long as fourth joint, first three segments subequal, fourth smaller but of moderate size; whole antenna densely hirsute, especially towards the end.

Uropoda with base broad, flattened, the two meeting in median line, dorsal surface with a slight longitudinal ridge down the centre, outer margin thin, produced, postero-lateral angle acute, produced; inner ramus inserted much anterior to outer, outer arising from a concavity at end of base, both reaching to same point; endopod with a few fairly long setæ at end, short setæ on other parts and on the exopod.

*Female.*—Differs from male in lacking the large balloon-like expansions of the first segment of the peræon, and in having the tubercles on the dorsal surface of the body much less developed and the antennæ more slender.

Length of male specimen 11 mm.; breadth 5 mm.; female rather smaller.

*Colour.* Slaty grey.

*Habitat.* Chatham Islands (*Miss S. D. Shand*) and Stewart Island (*Mr. Walter Traill & Prof. Benham*), New Zealand; Valparaiso Bay, South America (*Nicolet*).

I first recognised this species from specimens, unfortunately poorly preserved, sent to me from the Chatham Islands by Miss S. D. Shand; one female was taken at Port Pegasus, Stewart Island, during the Philosophical Institute of Canterbury's Expedition to the Subantarctic Islands of



New Zealand in 1907; subsequently Prof. Benham sent me a male and a female from the same locality, and quite recently Mr. Walter Trail has sent me two males and one female from the island of Ulva in Paterson Inlet, Stewart Island.

Filhol states that he collected the species near Wellington, but, though I have made many collections there, both personally and by the help of friends, I have not succeeded in finding it in that locality.

I feel confident that the species described by Nicolet from Chili are the same as the New Zealand one; his figures\* and description agree throughout, the large expansions of the first peræon segment in the male are quite characteristic, and his figure of the antenna of *Oniscus bucculentus* agrees closely with the one I now give (fig. 48), which was drawn before I had seen the plates of Nicolet's work. The form Nicolet described as *O. tuberculatus* is evidently the female, and, though he described it as a different species, he recognised that it resembled *O. bucculentus* except for the secondary sexual characters peculiar to the male.

A comparison of this species with *D. aucklandiæ* gives us a good example of the apparent capriciousness in the secondary sexual characters of these Crustacea. In *D. aucklandiæ* the differences are confined to the antennæ and the tuberculation of the body; in *D. bucculentus* we have similar sexual differences, though to a less degree, but in addition we have in the male the extraordinary balloon-like expansions on the first peræon segment, for which I know of no parallel among the Crustacea. What the function of these can be it is difficult to imagine; they appear, however, only to be developed to the full extent in the adult male; I have one specimen, a male, showing the usual male structure of the first and second pleopods, but the expansions, though large, are not so large as shown in fig. 45, taken from an older male, and their outline is slightly angular, indicating the normal shape of the segment; Filhol's figure shows a male in about the same stage of development; his figure, however, is poor, and shows the legs much too long—when in their normal position they are not visible in dorsal view.

Fig. 45 of the male is taken from a Chatham Islands specimen; in it the balloon-like expansions are somewhat flattened below, but very convex above, and the surface is thickly covered with minute spinules just as is shown in Nicolet's figure. In a specimen subsequently received from Paterson's Inlet, Stewart Island, the expansions are still larger and somewhat more separated from the segment itself; they are almost globular and strongly convex below as well as above, and the surface is almost smooth, showing only a slight wrinkled appearance, but apparently no minute spinules. The expansions are surrounded by a fairly thick chitinous integument, quite firm

\* I am indebted to Dr. W. T. Calman, of the British Museum, for obtaining photographs of Nicolet's plates for me.

and hard and rather difficult to cut through. On opening one I found it to be loosely filled with a soft white substance of a granular nature, showing no definite structure, but containing numerous globules of fat. In this Paterson's Inlet specimen the tubercles on the segments of the peræon are rather more developed and more acutely pointed, especially those near the sides, than in the Chatham Islands specimen.

The antennules (fig. 47) have the first joint about as long as the second and third together, the third being only about half the size of the second.

The antennæ are large and strong in the male (fig. 48), but not so greatly expanded as in *D. aucklandiæ*; the whole antenna is scabrous, with minute spinules, and bears also some fine setæ, especially towards the distal part. In the female (fig. 49) the antenna is much more slender and does not differ very much from that of the female of *D. aucklandiæ*.

The mouth-parts are, on the whole, similar to those of *D. aucklandiæ*. In the right mandible (fig. 50) the accessory appendage ends in a crown of small pointed teeth of irregular size, and the hairy lappet at its base bears a haired bristle similar to the "penicil" situated between the lappet and the tuft of bristles representing the molar tubercle; this tuft contains a large number of bristles varying in length, those towards the cutting-edge being the shortest. The left mandible (fig. 51) has four teeth in the outer cutting-edge and three in the accessory appendage, the other parts being the same as in the right. The lower lip (fig. 52) and the first maxilla (fig. 53) are similar to those of *D. aucklandiæ*; in the second maxilla (fig. 54) the outer lobe is much narrower than the inner one. The terminal portion of the maxilliped is shown in fig. 55, and does not differ in any essential detail from that of *D. aucklandiæ*.

The legs (fig. 56) are similar to those of *D. aucklandiæ*, though slightly more slender; they are all of about the same length, the posterior ones being only slightly longer than the anterior; in all, the inner surface of the joints, especially of the ischium, merus, carpus, and propod, is thickly covered with a dense fringe of short fine setæ; a few stout spinules are found on the different joints, as shown in the figures.

The pleopoda are, on the whole, similar to those of *D. aucklandiæ*, except that the exopod of the first pleopod (fig. 57) is not so much produced at its inner distal angle; the endopod is fairly stout, more than twice as long as the exopod, and is channelled on the posterior surface. The male organ reaches as far as the exopod. In the second pleopod (fig. 58) the terminal portion of the endopod forms an extremely long styliform process, about three times as long as the exopod, and a groove extends along its anterior surface throughout about two-thirds of its length.

The uropod (fig. 59) is, on the whole, similar to that of *D. aucklandiæ*, and has been sufficiently described in the specific diagnosis.

## GENERAL REMARKS.

The animals described above present many points of interest, some of which have been already briefly mentioned. Considering the large size of most of them and their striking appearance, it is rather remarkable that they have not been more fully described before this, but some of them occur in localities not very accessible, and, as has been mentioned under *D. marina*, even when the locality is accessible enough it is not always possible to find the specimens.

One of the most striking features is the great sexual dimorphism exhibited apparently by all the species, and the varied forms that this takes; thus in *D. bucculenta* the male differs from the female in the possession of the extraordinary balloon-like expansions of the first segment of the peræon; in *D. aucklandiæ* by the much longer and more prominent blunt spines on the dorsal surface; in *D. echinata* and in *D. armata* by the longer spines arising from the segments of the peræon; these are extremely long in *D. echinata*, and the capriciousness of the differences is shown in the fact that, although these two species appear to be closely similar in most respects, *D. armata* has spines on the peræon and also on the third and fourth segments of the pleon, while *D. echinata* has them only on the peræon. In *D. acinosa* the sexual differences are of a similar nature, but not so well marked; in *D. marina* the male is unknown.

All the species are strictly sea-shore inhabitants, probably not extending much above high-water mark or beyond the reach of the spray from the sea; in accordance with this they are all branchial breathers, and show no sign of the adaptation for aerial respiration exhibited by most of the other terrestrial Isopoda. In this respect, as well as in many points of structure, they agree with the genera *Scyphax* and *Scyphoniscus*, and it is probable that their nearest affinities will be found to be with these two genera. *Scyphax* differs from *Deto* in the very large and well-developed eye with its rows of numerous ocelli, and *Scyphoniscus* in the peculiar structure of the end of the outer lobe of the first maxilla; probably in both cases, however, these are characters of comparatively recent origin, and do not indicate a difference sufficient to counterbalance the many points of similarity.

The most interesting point connected with the species of *Deto*, however, is their geographical distribution, and they add a good example to the cases already known of closely allied forms being found on widely separated shores in subantarctic regions. *D. bucculenta*, from South America, which seems to be quite identical with the species described as *Oniscus novæ-zealandiæ*, from New Zealand, emphasises the close relationship between the fauna of New Zealand and that of the southern part of South America, and is paralleled by the existence of the freshwater Isopod *Idotea lacustris* in New Zealand and its Subantarctic Islands, and also in South America at the Straits of Magellan, and by the occurrence of *Trichoniscus magellanicus* and species

closely allied, if not identical, in the Subantarctic Islands of New Zealand, in Tierra del Fuego, the Falkland Islands, and Marion Island. Numerous other examples of similar distribution among the Crustacea and in other groups will be found in my concluding article (1909 A) on the "Subantarctic Islands of New Zealand." The close connection of Australia, St. Paul's Island, and South Africa with one another, and with the other subantarctic lands is shown by the occurrence in these places of species of *Deto* closely allied to one another, and not differing very much from those in New Zealand and South America. Another striking example of the same kind of distribution has recently been afforded in the discovery by Mr. Keppel H. Barnard † in freshwater streams of Cape Colony of a species of *Phreatoicus*, a genus hitherto known only from the surface and subterranean freshwaters of Australia and New Zealand. Probably further exploration will result in the discovery of species of *Deto* and of *Phreatoicus* on other subantarctic lands from which they have not yet been recorded.

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#### EXPLANATION OF THE PLATES.

##### PLATE 39.

- Fig. 1. *Deto echinata*, male, dorsal view.  $\times 2\frac{1}{2}$ .  
 2. " " male, antennæ of same.  $\times 8$ .  
 3. " " male, uropod of same.  $\times 8$ .  
 4. *Deto acinosa*, male, dorsal view.  $\times 4$ .  
 5. " " female, dorsal view.  $\times 4$ .  
 6. " " antenna of male.  $\times 12$ .  
 7. " " upper lip.  $\times 12$ .  
 8. " " left mandible.  $\times 60$ .  
 9. " " lower lip.  $\times 30$ .  
 10. " " second maxilla.  $\times 30$ .  
 11. " " maxilliped.  $\times 30$ .

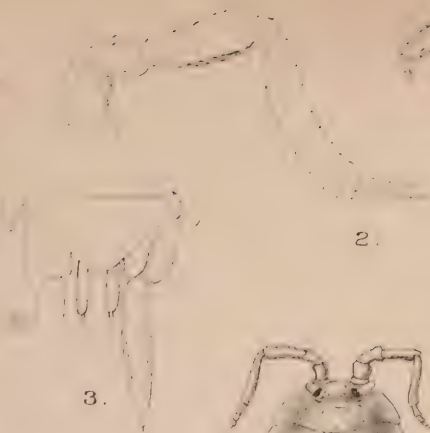
- Fig. 12. *Deto acinosa*, first leg of male.  $\times 20$ .  
 13. " " seventh leg of male.  $\times 20$ .  
 14. " " first pleopod of male.  $\times 20$ .  
 15. " " second pleopod of male.  $\times 20$ .  
 16. " " first pleopod of female.  $\times 30$ .  
 17. " " second pleopod of female.  $\times 30$ .  
 18. " " uropod of male.  $\times 20$ .  
 19. *Deto marina*, female, dorsal view.  $\times 12$ .  
 20. " " antenna of same.  $\times 25$ .  
 21. " " first leg of same.  $\times 40$ .  
 22. " " seventh leg of same.  $\times 40$ .  
 23. " " uropod.  $\times 40$ .  
 24. *Deto aucklandiæ*, male, dorsal view.  $\times 3$ .  
 25. " " female, dorsal view.  $\times 3$ .  
 26. " " antennule of male.  $\times 30$ .  
 27. " " antenna of male.  $\times 8$ .  
 28. " " antenna of female.  $\times 8$ .  
 29. " " right mandible of male.  $\times 20$ .  
 30. " " end of left mandible of male.  $\times 30$ .

## PLATE 40.

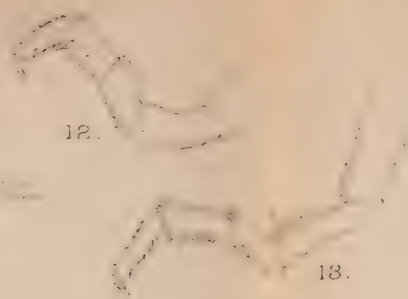
- Fig. 31. *Deto aucklandiæ*, lower lip of male.  $\times 12$ .  
 32. " " first maxilla of male.  $\times 12$ .  
 33. " " second maxilla.  $\times 12$ .  
 34. " " maxilliped.  $\times 12$ .  
 35. " " maxilliped, extremity of same, more highly magnified.  
 36. " " first leg of male.  $\times 8$ .  
 37. " " seventh leg of male.  $\times 8$ .  
 38. " " first pleopod of male, seen from anterior side.  $\times 12$ .  
 39. " " the same, from posterior side.  $\times 12$ .  
 40. " " second pleopod of male.  $\times 12$ .  
 41. " " fourth pleopod of male.  $\times 12$ .  
 42. " " first pleopod of female.  $\times 12$ .  
 43. " " second pleopod of female.  $\times 12$ .  
 44. " " uropod of female, from below.  $\times 8$ .  
 45. *Deto bucculenta*, male, dorsal view.  $\times 7$ .  
 46. " " female.  $\times$  about 5.  
 47. " " antennule of male.  $\times 30$ .  
 48. " " antenna of male.  $\times 12$ .  
 49. " " antenna of female.  $\times 12$ .  
 50. " " right mandible of male.  $\times 60$ .  
 51. " " left mandible of male.  $\times 60$ .  
 52. " " lower lip.  $\times 30$ .  
 53. " " first maxilla.  $\times 30$ .  
 54. " " second maxilla.  $\times 30$ .  
 55. " " end of maxilliped.  $\times 30$ .  
 56. " " seventh leg of male.  $\times 20$ .  
 57. " " first pleopod of male.  $\times 20$ .  
 58. " " second pleopod of male.  $\times 20$ .  
 59. " " uropod of male, from below.  $\times 12$ .



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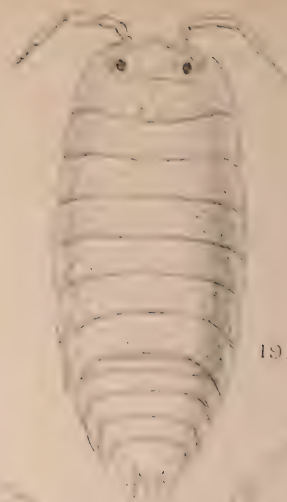


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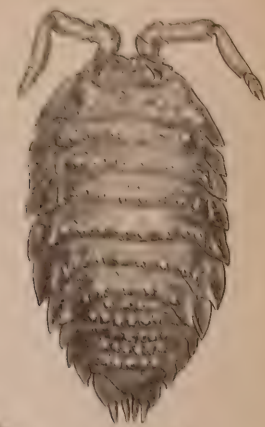


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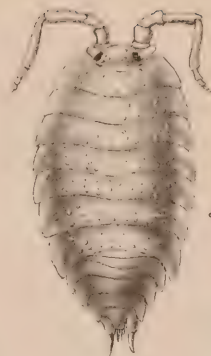


19.



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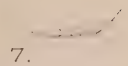
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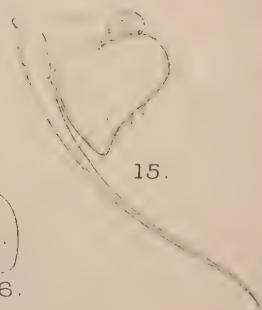
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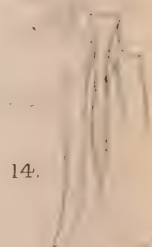
4.



7.



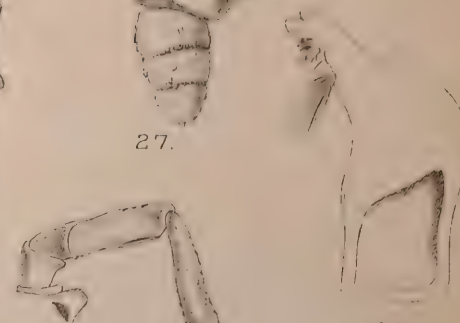
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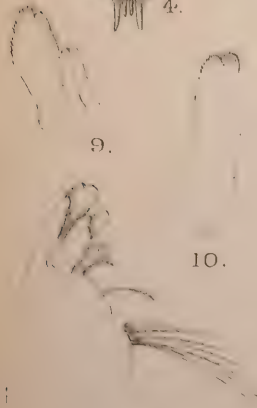
14.



24.



29.



8.



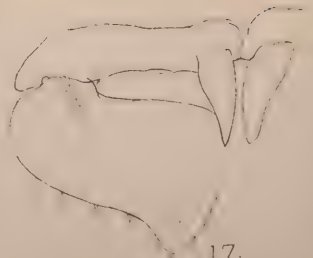
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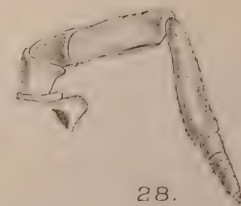
10.



11.



17.



28.



30.



26.

